ET 61 - Electrician Theory Examination Marking Schedule

Notes: 1. (1 mark) means that the preceding statement/answer earns 1 mark.

2. This schedule sets out the accepted answers to the examination questions. A marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.

Question 1	*Reference Marks*	*Marking notes*
(a) For the RCD to operate, an earth leakage path must exist.	(2 marks)	The question may confuse some. To gain marks, they must refer to "earth leakage"
(b) One phase could still be alive	(2 marks)	
(c) Any ONE of: ● Better mechanical protection. ● Cable damage is confined to within the cable.	(2 marks)	
(d) The fittings and accessories must be capable of withstanding the PSSC under fault conditions without damage.	(2 marks)	
(e) The protective devices must be capable of safely clearing the prospective short-circuit current without damage.	(2 marks)	
(f) Any ONE OF: ● To ensure that up-limit and down-limit of the hoist will operate correctly. ● To prevent the hoist going down when the up button is pushed. ● To prevent the hoist going up when the down button is pushed. ● To prevent the hoist motor operating in incorrect direction of rotation.	(2 marks)	
(g) The power will vary by the square of the change in voltage	(2 marks)	The effect can be explained by using calculations
(h) ● The thermistor detects a rise in temperature in the windings	(1 mark)	
● It opens the control circuit when a pre-set temperature has been exceeded.	(1 mark)	

Question 1			*Reference Marks*	*Marking notes*
(i)	(i)	A bi-polar junction transistor	(1 mark)	
	(ii)	A device that changes energy from one form to another	(1 mark)	
(j)	● ●	To limit the current flowing through the electrode and tube. To produce a high voltage when the starter opens to start the tube glowing.	(2 marks)	

Question 2	*Reference Marks*	*Marking notes*
(a) (i) Any ONE of: ● They have very inaccurate operating characteristics. ● The rewireable fuse may operate within 4 hours at 1.5 times the current rating.	(2 marks)	
(ii) Any ONE of: ● They have very accurate operating characteristics. ● The HRC fuse or MCB will operate within 4 hours at 1.5 times the current rating.	(2 marks)	
(b) A Pre-arcing time.	(1 mark)	
B Arcing time	(1 mark)	
C Total operating time.	(1 mark)	
D Any ONE of: ● Cut-off current ● Total fault current ● Cut-off characteristic	(1 mark)	
(c) The total of the pre-arcing time and arcing time of the 20A HRC fuse must be less than the pre-arcing time of the 63A HRC fuse.	(2 marks)	

Question 3	*Reference Marks*	*Marking notes*
(a) Final bake element	(½ mark)	
$R = \frac{V^2}{P}$		
$= \frac{230 \times 230}{12000}$	(½ mark)	
$= 4.41\Omega$	(½ mark)	
First bake element		
$R = \frac{V^2}{P}$		
$= \frac{230 \times 230}{8000}$	(½ mark)	
$= 6.61\Omega$	(½ mark)	
Pre-bake element		
$R = \frac{V^2}{P}$		
$= \frac{230 \times 230}{4000}$	(½ mark)	
$= 13.22\Omega$	(½ mark)	
Parallel elements		
$R = \frac{\text{Product}}{\text{Sum}}$	(½ mark)	
$= \frac{6.61 \times 13.22}{6.61 + 13.22}$	(½ mark)	
$= 4.41\ \Omega$	(½ mark)	
$R_T = 4.41 + 4.41$	(½ mark)	
$= 8.82$	(½ mark)	
(b) $I = \frac{V}{R}$	(½ mark)	
$= \frac{230}{8.82}$	(½ mark)	
$= 26.08A$	(1 mark)	
(c) $P = \frac{V^2}{R}$	(½ mark)	
$= \frac{230 \times 230}{8.82}$	(½ mark)	
$= 5997.73W$	(1 mark)	

Question 4	*Reference Marks*	*Marking notes*
(a) (i) It is the part of the loop where the impedance is consistently low. (ii) There is a high resistance joint in the main neutral conductor.	(2 marks) (2 marks)	
(b) ● Capacity (kA) of the supply source ● The impedance of the earth fault loop.	(1 mark) (1 mark)	
(c) ● To keep the voltage between neutral and earth to 0V. ● To ensure the voltage in the electrical installation does not rise above 230V under fault conditions.	(1 mark) (1 mark)	
(d) Any FOUR of: ● The main earth bar ● The main earthing conductor. ● The earth electrode ● The MEN connection (link) ● The main neutral bar ● The main neutral conductor ● Protective earthing conductors ● Equipotential bonding conductors	(2 marks)	

Question 5	*Reference Marks*	*Marking notes*
(a) (i) Any ONE of: ● A high-resistance joint in the protective earthing circuit. ● An open-circuit in the protective earthing conductor.	(1 mark)	
(ii) ● Repair faulty protective earthing conductor circuit	(1 mark)	
● Conduct an earth continuity test	(½ mark)	
To ensure the resistance is 1Ω or less	(½ mark)	
● Any ONE of: * Conduct an insulation resistance test.	(½ mark)	
to ensure the insulation resistance is 1MΩ or more. * Conduct an earth leakage test. * to ensure that the leakage does not exceed 5 mA.	(½ mark)	
(b) Any ONE of: ● To ensure capacitive or inductive reactance does not influence the test result. ● A constant maximum voltage is a more stringent test than the momentary peaks of an a.c. waveform.	(2 marks)	
(c) To ensure that no phase/neutral transposition has occurred.	(1 mark)	
(d) There is a high impedance somewhere in the earth fault loop.	(1 mark)	
(e) Any ONE of: ● Under fault conditions, the protective devices will not operate within the required time. ● The voltage may rise or fall. ● Dangerous touch voltages may appear of bonded conductive or extraneous parts.	(2 marks)	

Question 6	*Reference Marks*	*Marking notes*
(a) (i) The fluorescent tube gives 100 flashes of light per second from the 50 Hz a.c. supply.	(2 marks)	
(ii) If the strobing of the light matches the rotating machine, the machine can appear to be stationary.	(3 marks)	
(iii) Any ONE of: ● Install a lead/lag twin light fluorescent fitting. ● Install an electronic ballast in the fluorescent fitting. ● Mix incandescent lighting with the fluorescent light.	(1 mark)	
(b) When a fault occurs in fluorescent light B only the 1A fuse in that light will operate.	(2 marks)	
(c) Any ONE of: ● The wiring and components in the light fittings have a much lower current rating that the final circuit. ● The wiring and components in the light fitting are not capable of withstanding high fault currents ● There may be no discrimination between the light fitting and the MCB	(2 marks)	

Question 7	*Marks*	*Reference*	*Marking notes*
(a) (i) $V_{SPhase} = \frac{V_P}{N_P}$	(½ mark)		
$= \frac{50000}{217}$	(½ mark)		
$= 230.4V$	(1 mark)		
(ii) $V_{SLine} = VPH \text{ x } \sqrt{3}$	(½ mark)		
$= 230.4 \text{ x } \sqrt{3}$	(½ mark)		
$= 399 \text{ V}$	(1 mark)		
(iii) $I_{PLine} = \frac{kVA}{\sqrt{3} \text{ x } V_L}$	(½ mark)		
$= \frac{250000}{\sqrt{3} \text{ x } 50000}$	(½ mark)		
$= 2.87A$	(1 mark)		
(iv) $I_{SLine} = \frac{kVA}{\sqrt{3} \text{ x } V_S}$	(½ mark)		
$= \frac{250000}{\sqrt{3} \text{ x } 399}$	(½ mark)		
$= 361.76A$	(1 mark)		
(b) A high voltage can be present at the secondary terminals.	(2 marks)		

Question 8	*Reference Marks*	*Marking notes*
(a) (i) ● Disconnecting the fixed wired appliances ● Disconnecting the final sub circuit at the switchboard	(½ mark) (½ mark)	
(ii) ● Selecting the insulation resistance function ● Selecting the 500V range	(½ mark) (½ mark)	
(iii) Testing between the phase and neutral of the final subcircuit at the switchboard.	(2 marks)	
(iv) An extremely low reading on the insulation resistance tester.	(1 mark)	
(b) (i) ● Disconnecting the fixed wired appliances	(1 mark)	
(ii) ● Selecting the resistance function ● Selecting the lowest range or auto-range	(½ mark) (½ mark)	
(iii) Testing between the phase and neutral of each electrical appliance.	(2 marks)	
(iv) Much less than the resistance of the appliance in normal service	(1 mark)	

Question 9	*Reference Marks*	*Marking notes*
(a) Output power	(½ mark)	
$P = \frac{2\Pi \times N \times T}{60}$		
$= \frac{2 \times 3.142 \times 1440 \times 66.315}{60}$	(½ mark)	
= 10 kW	(1 mark)	
(b) Input power	(½ mark)	
$P = \frac{\text{Output power}}{\text{Efficiency}}$		
$= \frac{10000}{0.9}$	(½ mark)	
= 11.11 kW	(1 mark)	
(c) $I_L = \frac{P_{Input}}{\sqrt{3} \times V_L \times pf}$	(½ mark)	
$= \frac{11110}{\sqrt{3} \times 400 \times 0.86}$	(½ mark)	
= 18.65A	(1 mark)	
(d) $N = \frac{60f}{P}$	(½ mark)	
$= \frac{60 \times 50}{2}$	(1 mark)	
= 1500 rpm	(½ mark)	
(e) $S = \frac{N\ sync. - N\ r \times 100}{N\ sync.}$	(½ mark)	
$= \frac{1500 - 1440 \times 100}{1500}$	(½ mark)	
= 4 %	(1 mark)	